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Vertically Nanostructured Plasma Polymer Films Controlling Surface and Subsurface Functionality DIRK HEGEMANN, EZGI BULBUL, SANDRA GAISER, MANFRED HEUBERGER, Swiss Federal Lab for Mat Sci and Tech — Deposition of plasma polymer films (PPFs) occurs via plasma activation of a monomer (here: hexamethyldisiloxane, HMDSO) yielding excited intermediates and conversion into highly reactive film-forming species. The conversion is given by the transferred energy depending on electron temperature and the available energy per monomer molecule in the gas phase, while surface processes are governed by the deposited energy during film growth. This macroscopic approach was used to shed light on the deposition mechanism for HMDSO plasmas applied to control deposition rate, chemical composition, film density, porosity, and functionality at the nanoscale[1]. Hydrophobic nanolayers with defined density can be deposited on similar materials such as PDMS or SiO_x fully covering their surface. 2 nm-thick hydrophobic cover layers on PDMS substrates of different crosslinking degree are used to clarify the role of viscoelastic properties on bacterial growth indicating the lack of mechanosensing abilities [2]. Likewise, hydrophobic cover layers with varying film density are explored to control water intrusion. Thus, barrier properties of dense SiO_x films can be enhanced or a defined volume of water can be allowed to penetrate a porous SiO_x base layer. Protein adsorption of BSA is found to be affected by this hydration effect due to orientation of water molecules in the subsurface [3]. Recent progress in the understanding of plasma polymerization processes thus enables the design of combined subsurface/surface functionalities.

[1] D. Hegemann, S. Gaiser, M.R. Wertheimer et al., *Phys. Chem. Chem. Phys.* 21 (2019) 8698 [2] F. Pan, D. Hegemann, E. Blbl, Q. Ren et al., *Mater. Horiz.* 7 (2020) 93 [3] E. Blbl, M. Heuberger, D. Hegemann et al., *ACS Appl. Mater. Interfaces* 11 (2019), 42760

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